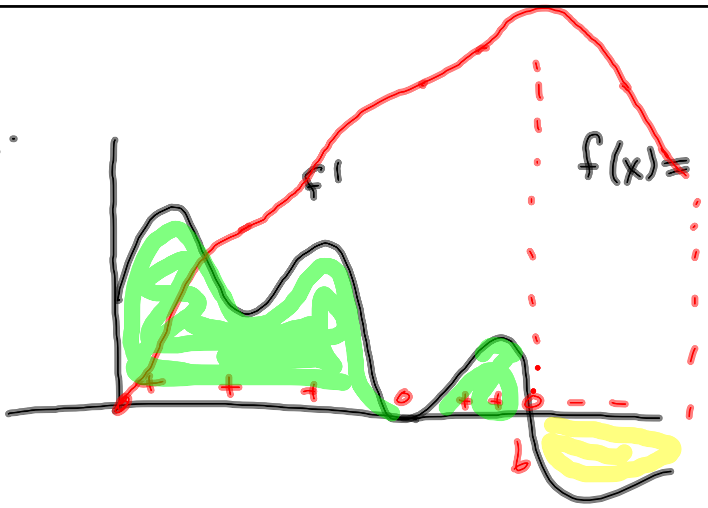
9.



$f(x) = \int_0^x f'(t)\,dt$

max at 6

9. $\frac{d}{dx} x e^{\ln x^2} = \frac{d}{dx} x \cdot x^2 = 3x^2$

Mar 30-11:31 AM

11. $\frac{1}{2}\int_1^\infty \frac{2x}{(1+x^2)^2}\,dx$

$u = 1+x^2$

$du = 2x\,dx$

$\frac{1}{2}\int \frac{2x\,dx}{(1+x^2)^2} = \frac{1}{2}\int \frac{du}{u^2}$

$= -\frac{1}{2}\frac{1}{u} = -\frac{1}{2u} = \frac{-1}{2(1+x^2)}$

$\lim_{b\to\infty} \frac{-1}{2(1+x^2)}\Big|_1^b = \lim_{b\to\infty} \frac{-1}{2(1+b^2)} + \frac{1}{2(1+1)}$ ($\to 0$)

$= \frac{1}{4}$

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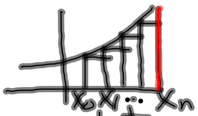
Review 17

Riemann Sums, Accumulation Functions

Riemann sums

rectangular

left - leave off last one (right most)

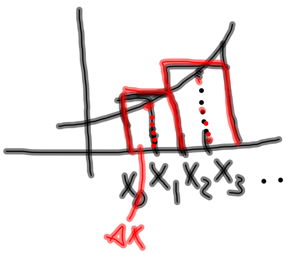


$[f(x_0) + f(x_1) + \ldots + f(x_{n-1})]\Delta x$

right - leave off first one (left most)

$(f(x_1) + f(x_2) + \ldots + f(x_n)]\Delta x$

mid - leave off every other one



$(f(x_1) + f(x_3) + f(x_5) \ldots) 2\Delta x$

twice as big

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p174 # 2

distance $= \int_0^{10} |v(t)|\, dt = \int_0^{10} v(t)\, dt$

approx with lram, rram

a) left

$[0 + 6 + 10 + 16 + 14 \ldots 4] \cdot 1$

b) right

$[6 + 10 + 16 + \ldots + 4 + 2] \cdot 1$

works because of uniform Δx's

c) mid pts:

$[6 + 16 + 12 + 22 + 4] \cdot 2$

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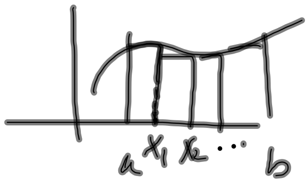
$$\lim_{\Delta x \to 0} \sum f(x_i)\Delta x = \int_a^b f(x)\,dx$$

$$\Delta x = \frac{b-a}{n}$$



$x_1 = a + \Delta x$

$x_2 = a + 2\Delta x$

$x_3 = a + 3\Delta x$

$\vdots$

$x_i = a + i\Delta x$

$= a + i\left(\frac{b-a}{n}\right)$

$$\lim_{n \to \infty} \sum_{i=1}^{n} f\left(a + i\left(\frac{b-a}{n}\right)\right)\frac{b-a}{n} = \int_a^b f(x)\,dx$$

$$\lim_{n \to \infty} \sum_{i=1}^{n} \sqrt{\frac{i}{n}}\,\frac{1}{n} = ?$$

$\frac{i}{n}$ — x_i

what if $a = 0$

then $b = 1$

$\Delta x = \frac{1}{n}$

$x_i = i\Delta x = i\frac{1}{n}$

$$\lim_{\Delta x \to 0} \sum \sqrt{x_i}\,\Delta x = \int_0^1 \sqrt{x}\,dx$$

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Accumulation Functions (function defined by an integral)

$$F(x) = \int_a^x f(t)\,dt$$

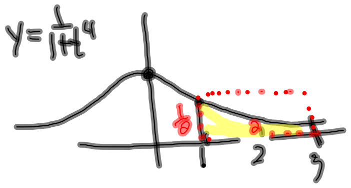
$$F'(x) = f(x)$$

ex. $f(x) = \int_0^x \frac{1}{1+t^4}\,dt$

a) $f(0) = 0$

b) $f'(1) = \frac{1}{2}$ $\quad f'(x) = \frac{1}{1+x^4}$ F.T.C.

c) show that $f(3) - f(1) < 1$



area of rectangle $= 1$

$f(3) - f(1)$ is yellow area

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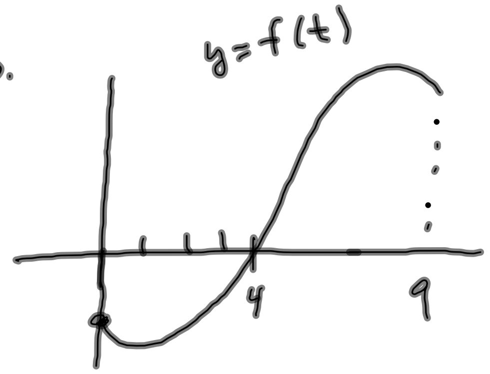
ex 2.



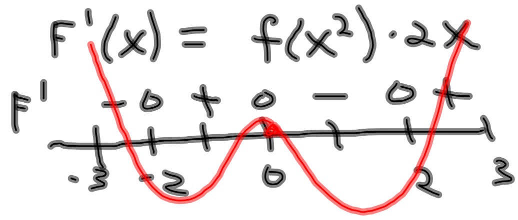
$F(x)=\int_0^{x^2} f(t)\,dt$

a) domain of $F(x)$ [-3, 3]

b) extrema of $F(x)$ on (-3, 3)

c) graph $F(x)$

b) $F'(x) = f(x^2)\cdot 2x$



min at $x=-2, 2$

max at $x=0$

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